BRIEF – Automated Load Management for EVSE Interconnection

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Recommendation:

Enable customers, via Rules 2/3/15/16, a new energy management tariff, or any new tariff for electric vehicle (EV) make-ready infrastructure, to elect certified behind the meter load management technologies to avoid primary and / or secondary upgrades, and make the Point of Common Coupling (PCC) the focus of capacity assessments rather than the aggregate capacity of individual behind the meter assets such as EV supply equipment (EVSE) and other distributed energy resources (DERs). Behind the meter load management systems are proven, Underwriters Laboratories (UL)-certified and National Electric Code (NEC)-approved solutions that will significantly reduce the net cost of EV charging interconnection by avoiding distribution system upgrades. This policy recommendation should ultimately be applied on a technology agnostic basis, but vehicle-grid integration (VGI)-based upgrade avoidance is a relevant near-term use case that can be implemented as an option through the normal course of a utility's provision of EV infrastructure.

Background:

Current distribution planning processes and utility incentive structures in California will likely inhibit the cost-effective integration of new EV load to the grid over the next decade. When assessing new EV loads, utilities generally calculate the sum of the nameplate capacity of devices behind a customer meter and add a set percentage of extra capacity to account for peaks in usage. These assumptions do not adequately reflect the capabilities of load management technologies to dynamically control load at a customer site, keeping demand consistently below agreed upon levels and making loads more predictable for planning purposes.

Inclusion of Automated Load Management (ALM) technologies in distribution engineering and planning will increase utilization rates of existing connection capacity, and allow customers to avoid upgrades to primary and secondary distribution infrastructure when installing EV charging infrastructure whose aggregate rated capacity exceeds connection size but can be managed to safely and reliably remain within existing capacity limitations using ALM technology. This will reduce time and expense associated with energizing new EV load while minimizing the potential for cross-subsidization associated with EV-related infrastructure upgrades.

ALM capability allows an EVSE installation to dynamically limit its cumulative load to less than its aggregate nameplate capacity. The customer and the ALM system is aware of the site-level capacity constraint set by either their main breaker or their smart meter, and actively limits use accordingly. This allows utilities to base system engineering and design on the programmed EVSE capacity limit at the point of common coupling.

Importantly, this gives the customer the choice to manage their own electricity use behind their meter and an avenue to avoid costly distribution upgrades, which ultimately extends the reach of ratepayer-funded budgets for EV infrastructure. Customers are able to control both their imports and exports within limits settled upon at the Point of Common Coupling. The focus, therefore, should be on how to take this capability into account in interconnection studies and distribution planning. The question should be whether these capabilities would be most appropriately reflected in a technology-agnostic energy management tariff, adjustments to Rules 2, 3, 15, and 16, or as part of any new tariff(s) created to provide standardized, program-agnostic access customer access to make-ready infrastructure.

Relevant use cases:

- Commercial and Industrial (C&I) customers
    - Service/delivery fleets
    - Employee parking
    - Long-term parking
- Medium Duty/Heavy Duty charging
- Multi-unit dwellings
- Single family dwellings
- DER-backed DCFC

Current deployment: Examples will illustrate the variety of implementation methods currently available

- In California, we are aware of deployments of ALM technology in SCE and LADWP territories from accounts by the vendors that completed the connections. There may be others.
    - These have been based on the ALM allowance in the National Electrical Code 625.42
- In UK, ALM is becoming a standard EVSE feature.
    - The EO Hub: A device external to the EVSEs, that works with a Current Transformer (CT) clamp to actively monitor current for active energy management with readings at 15-minute intervals. Able to work with up to 30 “non-smart” chargers" to regulate energy consumption as a portion of overall dynamic facility load.[1]
    - There is no standard for this specific application, but UK Distribution System Operators are interested in and encouraging the technology. There is already an export-limiting standard, known as Engineering Recommendation G100[2], that will likely be the basis for coming balancing of EVSEs with other behind the meter resources such as solar and batteries.
- In France, multiple companies have rolled out products commercially.

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[1] https://www.zap-map.com/eo-unit-allows-smart-ev-charging-from-standard-points/

[2] “Technical requirements for Customer Export Limiting Scheme. Engineering recommendation G100 Issue 1 Amendment 2 2018, https://www.energynetworks.org/assets/files/ENA_EREC_G100_Issue_1_Amendment_2_(2018).pdf

    - Schneider Electric's EV Link load management system connects the EVSE directly to the facility or house's smart meter for dynamic load management, taking readings at sub-second intervals.[3]
- In Hawaii, this technology has not been applied yet to EVs, but rather to solar plus storage installations, specifically to mitigate the need of primary and secondary upgrades. Below are some notes on the placement of relevant passages inserting ALM into the Hawaiian Electric Company (HECO) rule structure.
    - HECO Rule 14 "Interconnection of generating facilities operating in parallel with the company's electric system" paragraph H[4] contains this phrase: "Technical System Size refers to the maximum possible simultaneous generation (including discharge of energy storage systems) of the Generating Facility, and is calculated as the lesser of the sum of all inverter strings of the aggregate system or the maximum amount of export as permitted by the existence of an on-site limiting element that caps the amount of the Generating Facility's export at the Point of Common Coupling ('PCC')".
    - Rule 22 contains HECO's requirements for this functionality[5]:
        - "To prevent the unpermitted reverse power flow, or Net Export, from the Customer's Generating Facility across the Point of Interconnection, the use of an internal transfer relay, Energy Management System, or other Company approved Customer Facility hardware or software system(s) is required…" addressing Inadvertent Export, Nameplate Rating, Net Export Limit, Grid Support, Cease to Energize, and Control System Failure
    - Technical requirements are in the Source Requirements Document for compliant inverters, which in fact references California's UL 1741SA standard.[6]

Alternatives and Complements:
Retail price signals: Alternatives to ALM solutions at customer sites include price signals such as time-of-use rates, demand charges, and incentives from demand response or smart charging programs. However, these do not address the risk that the customer will have a peak event far in excess of average usage. In these instances, utilities must meet the customer's need for both

[3]Schneider Electric EV Link Load Management System User Guide 2020, Page 9
https://www.se.com/ww/en/product-range-download/62159-evlink-load-management-system/#/software-firmware-tab

[4]Hawaiian Electric Company Rule 14: Service Connections and Facilities on Customer's Premises. "Definition mm1", Page 20.
https://www.hawaiianelectric.com/documents/billing_and_payment/rates/hawaiian_electric_rules/14.pdf
[5] Hawaiian Electric Company Rule 22: Customer Self-Supply. "Option 5", Page 25
https://www.hawaiianelectric.com/documents/billing_and_payment/rates/hawaiian_electric_rules/22.pdf

[6] Hawaiian electric companies grid support utility-interactive inverter standards source requirements document for certification with underwriters laboratories 1741 supplement sa
https://www.hawaiianelectric.com/Documents/products_and_services/customer_renewable_programs/SRD_UL1741_SA_V1.1_20170922_final.pdf

energy and connection capacity, leaving the customer largely unaware of capacity constraints. Utilities plan and construct upgrades to primary and secondary distribution infrastructure to account for current load and anticipated future load growth, and customers can access nearly unlimited energy service from the utility as long as they are willing to pay for it. Time-of-use pricing as currently offered generally lacks the granularity and flexibility for load control of EVs behind meters with other DERs, and at the scale of rollout the state of California is hoping to achieve in the next decade. EV-specific time-of-use rates also run the risk of excluding VGI use cases that require any association with other loads or resources, baselining for demand response, or ability to respond to any price signal other than the retail time-of-use rate. This effectively isolates the EV, merely adding it to the grid rather than integrating it to the grid. This proposal combines well with rates that are designed to recognize and value the inherent flexibility of EV charging, and the potential for EVs to combine with other forms of storage and on-site renewable energy generation.

<u>Building code revisions</u>: It is currently possible, under NEC Section 625.4, to oversubscribe load if ALM systems are present (see next section, "Maturity of standards/permitting"). In isolation, this current pathway for ALM facilitated by the electrical code does not enable the state to scale ALM solutions, but clarity as to how the NEC treats load management technologies is a necessary and complimentary element to this proposal. Any revisions of local, state, and national building codes to facilitate easier installation of EVSEs should include elements such as an acknowledgement of ALM capabilities to limit on-site loads within set parameters.

Maturity of standards/permitting:

There are two relevant UL standards we are aware of today, UL 916 and UL 1741 Certificate Requiring Decision (CRD) for Power Control Systems, which, when applied in accordance with the ALM System option in NEC 624.14, would be theoretically sufficient to allow over-subscription of EV load. UL 916 is a mature standard with an associated testing and certification regime that has been used to interconnect EVSE ALM in California, though the standard is not explicitly applicable to EVSE technology. The UL 1741 CRD is published but does not have testing procedures yet. There is also the potential for UL to incorporate ALM capabilities into the primary standard for AC EVSE certification, UL 2594.

Companies operating in California have reported that the NEC 625.4 section refers to an ALM option, but ALM is otherwise undefined by that standard. Therefore, it is the responsibility of the vendor to get acknowledgement from the Authority Having Jurisdiction (AHJ) that a given standard is valid for ALM as described in NEC 625.4, and that the vendor's technology meets that standard. This currently occurs on a case-by-case basis, and roll-out of this technology in California has so far been limited.

That said, it is clear from the examples in the Current Deployment section above that there are a variety of ways to implement energy management technologies. We caution that seeking standardization of the different possible technical approaches to providing ALM services prior to addressing the grid planning implications of ALM technology may stifle the type of innovation evident in the given examples. It also may delay implementation of what is clearly an essentially piece of the VGI and DER integration puzzle. Whether using cloud platforms, CT clamps, direct connections to a smart meter, or other methods, the examples given in the Current Deployments section demonstrate that there are multiple ways to arrive at the same outcome. We should not focus on the specific enabling technology, but rather on the outcome.

Barriers/inefficiencies in current regulatory/market scheme:

- Misalignment of utility incentive structures;

- Lack of recognition of energy management capabilities in methods of distribution engineering, planning, and interconnection studies;

- Utility concern regarding lack of mature, universally recognized standards regimes for EVSE load management systems prior to rollout. We highlight that SCE and some Municipal utilities have allowed limited rollout in their territories despite this.

- Inexperience in integrating EVs as flexible loads at scale.

- Utility load assessments focus on the maximum rated capacity of behind the meter devices instead of the PCC, which points to a fundamental shift in practice that needs to occur for this technology to be truly effective as a method of decreasing the need for primary and secondary upgrades, shortening time to energization for individual customers, and reducing cost of transportation electrification for California ratepayers.